Dates of first light and heavy frosts and snow—Continued.

State and station.	First frost.		Snow.
	Light.	Heavy.	
Texas—Cont'd.			
Dallas		17	
Duval		17	
Fort Worth		17	
Fredericksburg†		6	
Graham†		3	
Grape Vine		6	
Hallettsville		20	
Hearne†		17	
Huntsville†		16	
Lampasas		19	
Llano		17	
Longview†		17	
Luling		20	
Marshall		12	
Mountain Spring		17	
New Braunfels		20	
Palestine		11	
Paris†		11	
Rocksprings†		16	
Round Rock		20	
San Marcos†		7	
Silver Falls†		5	
Temple†		11	
Tyler†		6	
Waco†		17	
Weatherford		11	
Wichita Falls†		11	
Vermont.			
Cornwall			5
Hartland			5
Irasburg			5
Jacksonville			5
Norwich			5
Vernon			5
Wells			5
Virginia.			
Alexandria†		6	
Ashland			11
Virginia—Cont'd.			
Avon†		4	11
Bedford†		7	11
Birdsnest			12
Blacksburg			5
Buckingham			11
Dale Enterprise			6
Grahams Forge†		11	5
Hampton		7	
Irwin			12
Lexington			5
Lynchburg		11	11
Petersburg			11
Richmond†		11	11
Rocky Mount			6
Salem†		3	5
Smithville†		11	
Spottsville			6
Staunton			6
Warsaw†		7	
Whittles Depot			11
Wytheville			5
Washington.			
Aberdeen		15	
Blaine			17
Bridgeport			22
Colfax			22
Conconully			23
Ellensburg			23
Fort Canby	4	16	
Fort Simcoe			23
Fort Spokane			23
Hunters			16
Lakeside			22
Moxee Valley			22
Neah Bay†		15	
Port Angeles		16	
Rosalia			21
Seattle	15	16	
Washington—Cont'd.			
Spokane			23
Tatoosh Island	16		
West Ferndale			16
West Virginia.			
Bloomery			6
Burlington			6
Charleston			10
Creston			6
Elkhorn			5
Ella			6
Fairmont			6
Glenville			6
Grafton			6
Madison			6
Marlinton			5
Morgantown			6
New Cumberland			5
Parkersburg			6
Philippi			6
Point Pleasant			10
Powellton			5
Raleigh			6
Rowlesburg			6
Spencer			6
Weston			5
Wheeling			6
Wisconsin.			
Amherst			7
Antigo			2
Ashland			2
Baraboo			7
Barron			3
Bayfield			8
Beaver Dam			4
Beloit			7
Black River Falls			7
Centralia			6
Chippewa Falls			4
Wisconsin—Cont'd.			
City Point			3
Columbus			7
Crandon			1
Delavan			7
Depere			5
Eau Claire			2
Florence			2
Fond du Lac			7
Hartford			7
Harvey			7
Hayward			6
Hillsboro			2
Janesville			7
La Crosse			2
Lancaster			4
Lincoln			7
Madison			7
Manitowoc			7
Meadow Valley			7
Menomonie			2
Milwaukee			7
Neillsville			9
Oconto			7
Oshkosh			7
Pepin			1
Portage			7
Port Washington			7
Prairie du Chien			7
Reedsburg			7
Royalton			7
Shawano			6
Spooner			3
Stevens Point			3
Valley Junction			7
Viroqua			2
Watertown			7
Waukesha			7
Westfield			7
Weston			3

HUMIDITY.

WET-BULB OR SENSIBLE TEMPERATURES.

The sensation of heat experienced by the human body and attributed to the atmosphere depends not merely upon the temperature of the air, but especially upon its dryness and the force of the wind. Physiologists have explained this nervous sensation, erroneously called subjective temperature, as a condition due to the more or less rapid evaporation of the natural perspiration and the consequent drying of the outer layers of the skin.

Investigations were made into the relations between the moisture of the air and its physiological effects by Mr. J. W. Osborne, of Washington (see the Proceedings of the American Association for the Advancement of Science, 1876), and especially by the Chief of the Weather Bureau (see his memoir on "Sensible Temperatures," read before the American Climatological Association, June 1, 1894). It would seem that the rapid evaporation from the skin in dry, hot weather reduces the temperature of the layer of nerve cells at the surface of the skin. This reduction is not measurable by thermometers which give the temperature of large masses, but is appreciated by the minute nerves that end in these microscopic cells.

The reduction of temperature, or sensible coolness, is apparently proportional to the difference between the dry and wet bulb thermometers, and as shown by the chart accompanying Professor Harrington's memoir, it amounts on the average to 20° in the month of July in Arizona, Nevada, and Utah and 10° in Kentucky, Indiana, and Ohio. The resulting sensible temperatures, as shown on his second chart, are simply the so-called average temperatures of the wet-bulb thermometer in the shaded shelter, and correspond to the temperatures of persons standing in the shade of trees or houses, exposed to a natural breeze of at least 6 miles per hour, as obtained by the whirling apparatus used with the wet-bulb thermometer. The temperature of the wet-bulb thermometer and its depression below the dry bulb are the fundamental data for all investigations into the relation between human physiology and the atmosphere. In order to present a monthly summary of the atmospheric conditions from a hygienic and physiological point of view, Table I*a* has been prepared, showing the maximum, minimum, and mean readings of the wet-bulb thermometer at 8 a. m. and 8 p. m., seventy-fifth meridian time.

HUMIDITY.

The quantity of moisture in the atmosphere at any time may be expressed by means of the weight contained in a cubic foot of air. This is usually known as the absolute measure and is equivalent to giving the tension or pressure of the vapor, or the temperature of the dew-point. The mean dew-points for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, are given in Table I. These vapor pressures and the resulting dew-points, absolute humidities, and relative humidities are all deduced from observations of the wet-bulb thermometer by means of formulæ and tables that were first devised by August and subsequently modified by Regnault, 1845, and Ferrel in 1885, but which are still considered to be open to further improvement. In a general way the dew-points given in Table I are probably slightly lower than they should be, owing to the omission since 1887 of a correction for barometric pressure. There is also an uncertainty in the psychrometric formula which is only just now beginning to be understood, by virtue of which at temperatures below freezing the dew-points and the humidities are higher than they should be. For these reasons

the monthly averages of the dew-points and relative humidities are subject to some uncertainty.

AVERAGE HUMIDITY.

The temperature of the wet bulb of the psychrometer is the temperature at which evaporation is going on from a special surface of water on muslin at any moment, but a properly constructed evaporometer may be made to give us the *quantity of water evaporated* from a *similar surface* during any interval of time. Such an evaporometer, therefore, would sum up or integrate the effect of those influences that determine the temperature as given by the wet bulb; from this evaporation the average humidity of the air during any given interval of time may be deduced. Instead of attempting to make a self-registering wet-bulb thermometer we may use the evaporometer as an equivalent. A formula for determining the average vapor tension during an hour was given in 1887, at page 376 of the Treatise on Meteorological Apparatus and Methods (in the section on the use of the evaporometer as an integrating hygrometer), as based on the careful measurements made by Mr. Desmond Fitzgerald and published in the Transactions of the American Society of Civil Engineers, 1886.

PRECIPITATION.

[*In inches and hundredths.*]

The distribution of precipitation for the month of November, 1894, as determined by reports from about 2,000 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III; the first of these also gives the average departures from the normal for each district, whereas the average departure for each State is given in Table XII for each State Weather Service.

DIURNAL VARIATION.

Table IV*b* gives the total precipitation for each hour of seventy-fifth meridian time, as deduced from self-registering gauges kept at about 43 regular stations of the Weather Bureau; of these 37 are float gauges and 6 are weighing gauges.

NORMAL PRECIPITATION FOR NOVEMBER.

The normal precipitation for November is shown on Chart IX of the Atlas of Bulletin C, entitled "Rainfall and Snow of the United States, Compiled to the End of 1891, with Annual, Seasonal, Monthly, and other Charts," by Mark W. Harrington, Chief of the Weather Bureau, Washington, 1894. From this chart it appears that the region of greatest rainfall in November is from 5 to 12 inches along the coast of Washington and Oregon. The rainfall averages from 3 to 5 inches through central Oregon and Washington, northern and central California, and about 4 inches from the Gulf coast to New England.

PRECIPITATION FOR CURRENT MONTH.

The precipitation for the current November was heaviest in the extreme northwest corner of Washington; the maximum was 13.7 at Tatoosh Island and 14.7 at Neah Bay. The region of no apparent rain or snow covered southern California and Nevada, Utah, Arizona, New Mexico, and western Texas.

CURRENT DEPARTURES FROM NORMAL PRECIPITATION.

The precipitation for November was deficient over the whole of the middle and southern portions of the United States. There was an excess in Prince Edward Island and Nova Scotia, on the coasts of New York, New Jersey, Connecticut, and Rhode Island, on the coast of Washington, and along a belt covering Canada and the extreme northern part of the United States; also in a small region along the coast of Georgia and Florida and in middle Florida.

The principal departures from the normal at Weather Bureau stations were as follows:

Excesses: Sault Ste. Marie, 2.6; Tatoosh Island, 2.5; Olympia, 2.2; Marquette, 2.1; Port Angeles, 2.0; Neah Bay, 1.8; Fort Canby and Savannah, 1.7; Jacksonville, 1.1.

Deficits: Springfield, Mo., 6.8; Little Rock, 4.9; Memphis, 4.3; Mobile, 3.9; Pensacola, 3.7; Louisville, 3.4; Portland, Oreg., 3.3; Atlanta, New Orleans, and Corpus Christi, 3.1; Galveston, 3.0.

Considered by districts, the precipitation for November, 1894, when compared with the normal for the month, furnishes the departures given in Table I, as expressed in inches By dividing those departures by the normal precipitation for November, we obtain the following corresponding percentages (precipitation is in excess when the percentage of the normal exceeds 100):

Above the normal: North Pacific, 106; North Dakota (extreme northwest), 100.

Below the normal: New England, 93; middle Atlantic, 63; south Atlantic, 78; Key West, 39; east Gulf, 24; west Gulf, 28; Ohio Valley and Tennessee, 34; lower Lake, 53; upper Lake, 96; upper Mississippi, 60; Missouri Valley, 46; northern slope, 59; middle slope, 12; middle plateau, 13; northern plateau, 62; northern Pacific, 40; southern Pacific, 15.

Normal: Southern slope (Abilene) and southern plateau.

For certain voluntary stations of rather long periods of observation the normal and extreme monthly precipitations and the departures are shown in detail in Table X*b*, which is now placed among the meteorological tables instead of being inserted in the text as heretofore.

YEARS OF GREATEST PRECIPITATION FOR NOVEMBER.

The precipitation for the current month was not the greatest on record for the month of November at any regular Weather Bureau station.

YEARS OF LEAST PRECIPITATION FOR NOVEMBER.

The precipitation for the current month was the least on record for the month of November at regular Weather Bureau stations, as shown in the following table:

Station.	Current precipitation.		Previous minimum.	
	Amount.	Departure.	Amount.	Year.
Alpena, Mich.	1.41	— 1.5	1.43	1891
Buffalo, N. Y.	1.82	— 1.8	2.09	1875
Erie, Pa.	1.90	— 2.5	1.97	1893
Cincinnati, Ohio	0.98	— 2.4	1.22	1872
Memphis, Tenn.	0.49	— 4.3	0.90	1876
Little Rock, Ark.	0.63	— 4.9	2.64	1885
Shreveport, La.	0.87	— 4.0	1.39	1872
Wichita, Kans.	0.24	— 1.0	0.24	1892
Topeka, Kans.	0.35	— 1.2	0.60	1892
Concordia, Kans.	0.02	— 1.4	0.20	1891
North Platte, Nebr.	0.01	— 0.4	0.01	1882
Pueblo, Colo.	0.06	— 0.2	0.06	1893
Abilene, Tex.	T.	— 2.7	0.12	1891
Corpus Christi, Tex.	0.01	— 3.0	0.37	1890
El Paso, Tex.	0.00	— 0.6	T.	1891
Tucson, Ariz.	0.00	— 0.5	0.00	*
Yuma, Ariz.	0.00	— 0.3	0.00	*
San Diego, Cal.	0.00	— 0.8	0.00	*
Los Angeles, Cal.	0.00	— 1.5	0.00	*

*Frequently.

ACCUMULATED PRECIPITATION.

The total accumulated monthly departures from normal precipitation from the beginning of the year to the end of the current month are given in the second column of the fol-